ISO 14000 STANDARDS: VOLUNTARY ENVIRONMENTAL GOVERNANCE AS A TRADE FACILITATION STRATEGY?

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PRELIMINARY RESULTS: PLEASE DO NOT QUOTE

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INTRODUCTION

The continued increase in social and environmental consciousness, coupled with an increasingly globalized marketplace, has fostered an increasingly important role for independent environmental standards. Among the most widely recognized and internationally accepted of such programs is the ISO 14000 environmental management standard (EMS).

The intent of ISO 14000 is not to address specific, environmental issues such as green building (LEED), or green consumer product design and manufacture (Green Seal). Instead, its purpose is to provide firms guidance as to how they can: 'identify and control the environmental impact of its activities, products or services', systematically set and work toward environmental objectives and targets, and continually improve their environmental performance (www.iso.org). Companies that become ISO 14000 certified must develop, document and implement an extensive list of internal operational procedures regarding issues such as: emergency preparedness, industry/government regulations and agency approvals, training, contract control, and monitoring and measurement. Through this process organizations become more efficient, and are more capable of responding to the needs of their customers. Further, while certification requires companies to be regularly reviewed by third-party auditors, current and potential customers are provided assurance that their suppliers do adhere to their stated internal procedures. Overall, it has been reported that ISO14000 can positively impact both the performance of the environmental management system (EMS) as well as overall corporate performance (Montabon et al., 2006). It is not surprising then, that many firms use ISO 14000 as a minimum requirement of organizations with whom they are considering doing business. As of

December 2008, more than 188,000 companies in 155 countries were ISO 14000 certified (ISO Survey, 2008).

The potential benefits of this program are numerous and include production gains through reduced waste and more efficient use of energy and other inputs, and lower distribution costs. Of less tangible benefit, adherence to this standard is thought by some to be an effective tool to improve a corporation's image as a socially and/or environmentally conscious organization (Poksinska, 2003). Of particular value, this standard has been found to induce firms to progressively and meaningfully reduce their pollution output and better comply with government environmental regulations (Anton et al., 2004; Potoski and Prakash, 2005a, 2005b). Overall, it has been reported that ISO14000 can positively impact both the performance of the environmental management system (EMS) as well as overall corporate performance (Montabon et al., 2006).

Despite these touted benefits, this program is not without critics. The ISO 14000 program requires only that an EMS be implemented and continually improved upon, rather than mandating a certain level of environmental performance. As such, it has been charged this program can be used to 'greenwash' firms' poor environmental performance (Steinzor, 1998; King and Lenox, 2000). Also, critics often point to the ISO 14000 registration process as an exercise in documentation and formalization (Curkovic et al., 2004) which has reduced the commitment of certified firm employees to the program. Other challenges levied against the value of this standard are similar to that directed toward other general and/or voluntary standards. In particular, because ISO 9000 is both international and cross-industry in scope, its

potential benefits may be limited because the extent to which countries adhere to the demands of this standard remains unclear. For these reasons it is unclear what, if any, trade facilitation benefits are offered by ISO 14000 registration.

An extensive literature explores the impact of ISO 14000 standards on business operations. This research has focused largely the varied motivations of firms in different countries and industries of seeking ISO 14000 certification, and case-studies regarding the various benefits and costs which may be derived from it. From a macro perspective, the few studies examining patterns of adoption of ISO 14000 have reported that export dependence, environmental attitudes, ISO 9000 certification (Corbett and Kirsch, 2001), and the extent that trading partners have adopted this program (Potoski and Prakash, 2004) are significant factors in the uptake of this standard.

Ex post empirical econometric analyses examining the impact ISO 14000 on trade flows however, is surprisingly limited. Using trade-weighted ISO 14000 registration count data, Potoski and Prakash (2006) explored the impact of ISO 14000 on bilateral trade flows. While results of this analysis indicate that ISO standards can have a positive impact on trade, using this approach it is unclear if the ISO variables are picking up industrial county effects, or improved trade potential due to ISO 4000. In addition, the current research insufficiently controls for the levels of trading partner's environmental commitment, and the overlap in the adoption of this EMS and other business management standards (i.e. ISO 9000). Finally, although it is recognized that there is significant industry variance in the adoption of EMS programs, to date, industry considerations have been altogether omitted from these analyses.

The objectives of this study are three-fold. First, using the case study of ISO 14000, this study seeks to assess the trade facilitation impacts of international environmental management standards (ISO 14000)–a non-governmental association–on participating and non-participating members' international trade flows. Secondly, this study examines the question of whether countries who demonstrate a commitment to environmental protections trade more with other countries who similarly value the use of these environmental standards. Finally this study will attempt to quantify the market access effect of developing country exports to developed countries when developing nations have a relatively high proportion of ISO 14000 certified firms.

The remainder of this paper is organized as follows. Section two develops our empirical strategy, while section three describes the data used in this analysis. Section four presents descriptive statistics and formal econometric results, and in the final section we conclude.

2. METHODS AND DATA

The starting point of this analysis is the gravity equation applied to international trade flows:

$$(1) \qquad \ln M_{ijk} = \alpha_k + \beta_1 \ln\left(PR_{ik}\right) + \beta_2 \ln\left(PR_{jk}\right) + \sum_h \beta_h Z_{ij} + \lambda_1 \ln\left(\frac{ISO_{ik}}{F_{ik}}\right) + \lambda_2 \ln\left(\frac{ISO_{jk}}{F_{jk}}\right) + \varepsilon_{ijk}$$

where, M_{ijk} is the value of bilateral imports from country i to country j in industry k, α_k is a comprehensive set of industry-level fixed effects, PR_{ik} (PR_{jk}) is the value of sector k production of country i (j), and Z_{ij} is a set of extraneous factors influencing trade including distance, tariff rates and indicator variables for contiguous borders, common languages, landlocked countries,

island countries, free trade agreements, participation in the WTO and currency unions, and participation in environmental treaties.

It is usual for studies examining the impact of standards on trade to use only a simple count variable (e.g. the number of certified firms in country *i* or *j*) to estimate the trade flow effect of certification. Yet count variables in this context are fundamentally flawed. Do the trade increases reported in these studies reflect the fact that larger countries simply have more firms and therefore more ISO 14000 certifications compared to smaller countries (i.e., an industrial country effect)? Or is the count variable actually picking up improved trade potential due to ISO 14000? This is the fundamental problem with atheoretical count measures because it does not take into account the proportion of ISO 14000 certified firms in the *total number of firms* in the country.

In this study we address this common limitation by considering the number of ISO 14000 certified firms relative to the total number of firms in a given industry and country. As such, in this baseline version of the model (Eqn 1), the coefficients of particular interest are λ_1 and λ_2 which measure the trade flow impact of an change in the sector-specific proportion of ISO 14000 certified firms in country *i* or *j* ($ISO14_{ik}/F_{ik}$ and $ISO14_{jk}/F_{jk}$).

Alternative specifications of equation (1) are used to assess the second and third objectives. The second objective examines whether those with a commitment to voluntary environmental standards trade more with others who similarly subscribe to such programs. This potential preference by assessed by examining whether nations (industries) with above average adoption

of ISO 14000, prefer to import from those who also demonstrate above average certification rates.[1] Finally, through the third objective, the question of whether adherence to voluntary environmental standards offers any market access benefit for developing country exporters. This is assessed by incorporating additional dummy variables to indicate the development status of the exporter and importer and a series of interaction terms with $ISO14_{ik}/F_i$ and $ISO14_{jk}/F_j$ to test for market access effects of developing country exports to developed countries (and other combinations). Alternative specifications will also examine interactions between proportion of ISO 14000 and ISO 9000 certified firms.

Data

This analysis makes use of data drawn from a number of sources. Bilateral trade flows and are derived as described by Nicita and Olarreaga (2007) and the extended version of this dataset made available by the *Centre d'Etudes Prospectives et'Informations Internationales* (CEPII). Trade. Bilateral trade flows are derived from the United Nations Commodity Trade Statistics Database (COMTRADE). Real GDP data (in US dollars) are obtained from two primary sources: the World Bank (WB) Development Indicators database; and the United Nations (UN) National Accounts database. GDP data from the International Monetary Fund's (IMF) *Financial Statistics Yearbook* are used to supplement WB and UN data when it is missing or incomplete

Distance, contiguity, common language, island status and landlocked country indicators are taken from CEPII's geo-distance dataset (Mayer and Zignago 2006). CEPII uses the great circle formula to calculate the geographic distance between countries, referenced by latitudes and

[1] Specifically, do those with above average ISO 14000 certification ratios ($ISO14_{ik}/F_{ik}$) tend to trade more with exporters who also have above average certification ratios ($ISO14_{jk}/F_{jk}$).

longitudes of the largest urban agglomerations in terms of population. We also document whether trading partners are members of one or more of the same Regional Trade Agreements (RTAs).

To assess the impact of ISO certification on trade, this study makes use of the ISO Survey of Certifications which provides measures of the number of ISO 14000 certified firms by industry and country. The ISO Survey is an annual survey sponsored by the ISO Central Secretariat (ISO/CS) of the certification bodies accredited by the International Accreditation Forum (IAF). These surveys have been done since 1993 and through this source the aggregate annual (count) data of the number of ISO certifications in each country are available since this time. In more recent years, releases of the results of this survey have also been disaggregated by industry. It is the 2005 release of these results which is used in this analysis (ISO, 2005). This count data is combined with information regarding the number of establishments or enterprises in a given country, industry and year (Nicita and Olarreaga, 2007) to generate the ratio of ISO certified firms.

At the industry level, information regarding the number of ISO certifications classified according to the European Accreditation of Certification (EA) Code. Indicator and trade flow variables, however are aggregated at the industry level using ISIC (Rev. 2). Although, in broad terms, these classification systems are similar in their level of disaggregation, their concordance across industries is imperfect.[2] As such, for this analysis it was required that a new industry a new classification system be developed. This new industry classification system, and the mapping of

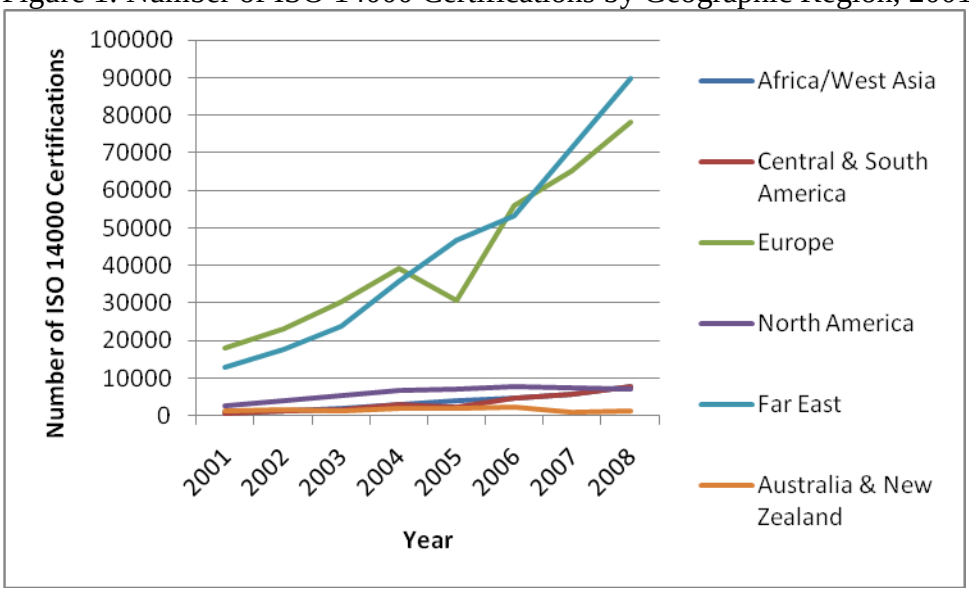
[2] By way of example, in some instances several EA classified industries (e.g. 'shipbuilding', 'other transportation equipment') map to one ISIC (rev. 2) sector (e.g. Transport equipment). For other industries, multiple ISIC sectors map into one EA sector.

these industries to those used to disaggregate the ISO certification count data (EA Codes) and the trade flow and indicator variables (ISIC rev. 2) is presented in Table 1. The completed cross-sectional dataset includes 243,000 observations reflecting trade flows between 221 importers and 73 exporters in 2005.

3. **RESULTS**

Adoption of the ISO 14000 standard has varied significantly across time and across industrial sectors. Figure 1 depicts the growth in the number of ISO 14000 certifications across major geographic regions. From this Figure it is clear that the Far East and Europe are, far and away, the largest adopters of this program. North America, Central & South America, Africa, and Australia and New Zealand all have similar and a relatively low absolute number of firms that are certified. Among this latter group, however, in recent years Central and South America has seen a relative increase in the adoption of this standard.

Figure 1: Number of ISO 14000 Certifications by Geographic Region, 2001-2008[3]



Data Sources: ISO, 2006; ISO, 2008.

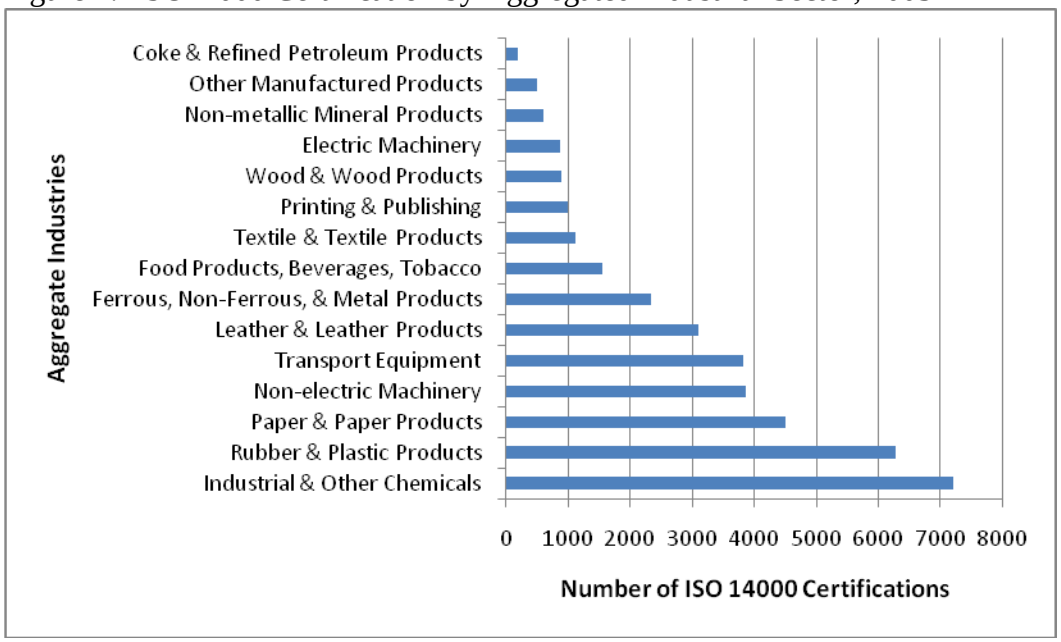
Also worth noting is the variable adoption of the ISO 14000 standard across industrial sectors. Figure 2 presents the aggregate number of ISO EMS certifications across the fifteen aggregate sectors used in this analysis.[4] As is quite evident, the use of this standard varies widely; chemical and plastic industries reflect among the highest adoption levels, and petroleum and an aggregate group of 'other manufactured products' (which includes nuclear fuel) are among those that least use this standard. Given the importance of environmental management among the

[3] On November 15, 2004, the original version of the ISO environmental management standard (ISO 14001:1996) was replaced by an updated version of this standard (ISO 14000: 2004). Firms accredited to the older version of the standard were provided 18 month to become compliant with and certified to the new version of the standard. Because the transition between use of these standards extended over several years and many firms opted not to become accredited to the new standard, dependent upon which version of the standard one is interested in (1996 or 2004) measures of the total number of certifications differ. The Figures presented herein reflect total number of ISO 14000 certified firms (certified to either standard version) in 2005 and 2006.

[4] Information regarding ISO 14000 certificates disaggregated by industry is available for many, but not all, countries. Of particular note, while the total number of certificates for North America is available and included among the annual certificate count included in Figure 1, industry disaggregation of North American certifications is not available and, as such, is not included among the information presented in Figure 2.

firms included in the least adopting industries, at first blush this result may seem odd. It is worth reemphasizing, however, that lack of adoption of this voluntary standard does not necessarily imply that firms or industries are no committed to environmental protection. Instead government regulations, or these industries themselves, may have established environmental guidelines which are mandated and are used in place of voluntary environmental management standards such as ISO 14000.

Figure 2. ISO14000 Certification by Aggregated Industrial Sector, 2005



Data Sources: ISO, 2006; ISO, 2008.

Econometric Results

Econometric results are presented in three subsections. Section 4.1 presents the core results assessing the benchmark model along with alternative sets of fixed effects commonly employed in the literature. Section 5.2 explores both whether a nation's (or region's) own environmental commitment translates into trade preferences for those firms who similarly demonstrate environmental commitment, and whether certification to the ISO 14000 standard can offer any

developed country market access benefit to firms in developing and least developed nations. All regressions are based on a cross-section of trade flow and ISO information from 2004.

Section 5.1

Table 2 present the baseline results of this analysis. In Scenario 1 the standard gravity model is combined with the two ISO 14000 variables of interest. In this, and all other regressions presented in both this and subsequent Tables, the standard gravity equation coefficients are economically plausible, statistically significant, and of the correct sign. As anticipated, the economic size (GDP) of both importers and exporters is consistently positive, and distance (Distance) has the typical negative coefficient close to unity. Sharing a boarder (Common Border), speaking a common language (Language), colonial relationships, and regional trade agreements all stimulate trade. National which are landlocked (Landlocked) tend to trade less, and island countries (Island) trade more.

The impact of ISO 14000 certification for importers and exporters are reflected by Ln ISO14 $Ratio_i$ and Ln ISO14 $Ratio_j$ respectively. In each regression in Scenario 1, the impact of certification to this environmental standard was found to be statistically significant for both importers and exporters. In the case of exporters, the effect was positive – higher ratios of ISO14000 certified firms in an industry resulted in a 27.6% increase in trade relative to instances where firms were not certified to this standard[5]. With regard to importers, however, the ISO 14000 certification ratio was found to be negatively correlated with increased trade. In this

[5] This trade impact is calculated by transforming the coefficient on the ISO ratio variable (0.244) in the following manner: (exp(0.244)-1)*100 = 27.6%.

instance, ISO certification was associated with a 57.8% decrease in trade. These results are robust in sign and larger in magnitude across scenarios which included industry fixed effects (Scenario 1.2) and country fixed effects (Scenario 1.3).

Section 5.2

Analyses in Table 3 future explore the question of whether or not importers who make relatively extensive use the ISO 14000 standard, preferentially import from industries who also make more extensive use of this standard. Results of this analysis are striking. Scenario 2.2 specifically examines imports by European and FarEast countries (EuropImp and FarEastImp respectively). Results suggest that ISO 14000 certification is significant and large facilitator of trade to both of these regions: in the case of Europe, certification is correlated to a remarkable increase of 285% in trade, while for the FarEast, certification is correlated with a 24% trade increase. Importantly, however, this positive effect does not extend to all 'Pro ISO 14000' importers. In examining the case of all importers with greater than average industry levels of ISO certification trading with exporters with the same characteristic trade actually decreased by 17% (Scenario 2.2) as compared to trade between countries where one or both partners were not 'Pro ISO 14000'.

A variable effect of ISO 14000 on trade between countries of various economic development status is examined. In Table 3 results of trade between partners who are both ISO certified is assessed. Unlike in Scenario 2.2 in which the regression was restricted to examining only those who had greater than average industry levels of certification, here all rates of certification are examined.

In Scenario 3.1, results are similar to those observed in the case of trade between those who have above average rates of ISO certification (Scenario 2.2); here again, increased levels of ISO 14000 certification lead to a 17% decrease in trade. Differences, however, are observed when this relationship is disaggregated by importer and exporter development status. When both trading partners are Developed, increased rates of certification by both trading partners can contribute to a notable increase in trade (Scenario 3.2). This trade facilitation benefit, however, does not extend to developing countries or LDCs who wish to export to developed nations (Scenarios 3.3-3.4). Similarly, in seeking to export to developing countries, ISO 14000 certification offers an advantage only to developed countries (Scenario 3.8); here again certification does not appear to improve market access for other developing countries or for LDCs to developing country markets (Scenario 3.9-3.10). Only in the case of improving trade with LDCs does this standard appear to offer a trade advantage.

CONCLUSIONS

Given that importers who make use of this standard to not, in general, appear to preferentially select trading partners who also make relatively high use of this standard (Scenario 1.3, 2.2), upon first blush, the finding that standard is correlated with a notable trade increase for exporters (Scenarios 1.1-1.3) is rather curious. It is possible that rather than the standard itself offering exporters a trade benefit, that certification to this standard indicates something about the firms which, instead, is conducive to trade facilitation. For example good internal reporting and responsive communication channels are required both by this standard and are necessary for effective international supplier-purchaser relationships. These types of characteristics may, instead be what is inducing the positive ISO 14000 trade response.

In examining the use of other ISO standards (i.e. ISO 9000), those with a higher use of this standard tend to trade more with those who themselves have a higher relative use of that same standard (Boys and Grant, 2009). This result is also supported on the firm level where several studies have found that companies adhering to a voluntary standard often prefer suppliers who themselves adhere to the same standard. As such, it may be that certification to another standard, or joint membership in another, similar program may be responsible for this result. These issues will be further examined in future iterations of this research.

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Table 1: Concordance of Industry Sectors

Industry Code		ISIC Rev. 2 Code		EA Code	
1	Food products, beverages, tobacco	311	Food products	3	Food products, beverages and tobacco
		313	Beverages		
		314	Tobacco		
2	Textiles and textile products	321	Textiles	4	Textiles and textile products
		322	Wearing apparel, except footwear		
3	Leather and leather products (incl. footwear)	323	Leather products	5	Leather and leather products
		324	Footwear, except rubber or plastic		
4	Wood and wood products (incl. furniture)	331	Wood products, except furniture	6	Wood and wood products
		332	Furniture, except metal		
5	Paper and paper products	341	Paper and products	7	Pulp, paper and paper products
6	Printing and publishing	342	Printing and publishing	8	Publishing companies
				9	Printing companies
7	Industrial and other chemicals	351	Industrial chemicals	12	Chemicals, chemical products & fibers
		352	Other chemicals	13	Pharmaceuticals
8	Manufacture of coke & refined petroleum products	353	Petroleum refineries	10	Manufacture of coke & refined petroleum products
		354	Miscellaneous petroleum and coal products		
9	Rubber and plastic products	355	Rubber products	14	Rubber and plastic products
		356	Plastic products		
10	Non-metallic mineral products (incl. glass, construction materials)	361	Pottery, china, earthenware	15	Non-metallic mineral products
		362	Glass and products	16	Concrete, cement, lime, plaster etc.
		369	Other non-metallic mineral products		
11	Ferrous, non-ferrous, and metal products	371	Iron and steel	17	Basic metal & fabricated metal products
		372	Non-ferrous metals		
		381	Fabricated metal products		
12	Non-electric machinery	382	Machinery, except electrical	18	Machinery and equipment
13	Electric machinery (incl. professional equipment)	383	Machinery, electric	19	Electrical and optical equipment
		385	Professional and scientific equipment		
14	Transport equipment	384	Transport equipment	20	Shipbuilding
				21	Aerospace
				22	Other transport equipment
15	Other manufactured products (incl. nuclear fuel)	390	Other manufactured products	23	Manufacturing not elsewhere classified
				11	Nuclear fuel

Table 2: Baseline Results

	Scenario		
	1.1	1.2	1.3
$lnGDP_i$	0.659 (0.003)*	0.697 (0.003)*	0.550 (0.023)*
$lnGDP_j$	0.870 (0.003)*	0.940 (0.003)*	0.878 (0.003)*
Distance	-0.952 (0.007)*	-1.015 (0.007)*	-1.048 (0.008)*
Common Border	1.064 (0.032)*	1.109 (0.030)*	0.965 (0.032)*
Language	0.413 (0.017)*	0.444 (0.016)*	0.330 (0.018)*
Common Colonial	0.587 (0.024)*	0.623 (0.023)*	0.616 (0.025)*
Colonial Relations Post 1945	1.059 (0.041)*	1.125 (0.038)*	1.112 (0.042)*
$Landlocked_i$	0.003 (0.019)	0.000 (0.018)	-0.010 (0.019)
$Landlocked_j$	-0.264 (0.017)*	-0.300 (0.015)*	-0.029 (0.234)
$Island_i$	0.742 (0.019)*	0.736 (0.018)*	0.781 (0.019)*
$Island_j$	0.232 (0.016)*	0.276 (0.015)*	1.859 (0.236)*
RTA_{ij}	0.819 (0.023)*	0.843 (0.022)*	0.799 (0.026)*
Ln ISO14 $Ratio_i$	-0.864 (0.040)*	-1.130 (0.038)*	-1.090 (0.044)*
Ln ISO14 $Ratio_j$	0.244 (0.040)*	0.836 (0.039)*	0.437 (0.043)*
Constant	-25.313 (0.128)*	-27.553 (0.123)*	-23.190 (0.537)*
Country Fixed Effects	No	No	Yes
Industry Fixed Effects	No	Yes	No
Observations	111,127	243,051	243,051
R-Squared	0.568	0.473	0.413
Root mean square error	2.303	2.526	2.667

Notes: *,** significant at 5% and 10% respectively.

Table 2: Objective II -

	Scenario	
	2.1	2.2
$lnGDP_i$	0.694 (0.002)*	0.676 (0.003)*
$lnGDP_j$	0.934 (0.002)*	0.962 (0.003)*
Distance	-1.013 (0.007)*	-1.018 (0.007)*
Common Border	1.124 (0.030)*	1.110 (0.030)*
Language	0.437 (0.016)*	0.436 (0.016)*
Common Colonial	0.623 (0.023)*	0.623 (0.023)*
Colonial Relations Post 1945	1.145 (0.038)*	1.097 (0.038)*
$Landlocked_i$	0.092 (0.018)*	0.000 (0.018)
$Landlocked_j$	-0.312 (0.015)*	-0.300 (0.015)*
$Island_i$	0.672 (0.018)*	0.736 (0.018)*
$Island_j$	0.274 (0.015)*	0.276 (0.015)*
Both in RTA_{ij}	0.790 (0.022)*	0.843 (0.022)*
Ln $ISO14\ Ratio_i$	-1.060 (0.025)*	
EuropeImp	1.350 (0.030)*	
FarEastImp	0.215 (0.054)*	
ProISO Importer - Exporter		-0.183 (0.020)*
Constant	-27.308 (0.122)*	-27.600 (0.124)*
Country Fixed Effects	No	No
Industry Fixed Effects	Yes	Yes
Observations	243,051	243,051
R-Squared	0.477	0.472
Root mean square error	2.518	2.530
Notes: *,** significant at 5% and 10% respectively.		

Table 2: Objective III -

	3.1		
$lnGDP_i$	0.676 (0.003)*	3.2 Developed-Developed	1.329 (0.086)*
$lnGDP_j$	0.962 (0.003)*	3.3 Developed - LDC	-3.670 (0.109)*
Distance	-1.018 (0.007)*	3.4 Developed - Developing	-1.874 (0.061)*
Common Border	1.110 (0.029)*		
Language	0.436 (0.016)*	3.5 LDC – Developed	1.423 (0.124)*
Common Colonial	0.624 (0.023)*	3.6 LDC – LDC	0.508 (0.176)*
Colonial Relations Post 1945	1.097 (0.038)*	3.7 LDC-Developing	0.773 (0.104)*
$Landlocked_i$	-0.005 (0.018)**		
$Landlocked_j$	-0.306 (0.015)*	3.8 Developing-Developed	1.944 (0.054)*
$Island_i$	0.761 (0.018)*	3.9 Developing-LDC	-2.525 (0.96)*
$Island_j$	0.236 (0.015)*	3.10 Developing-Developing	-0.768 (0.045)*
RTA_{ij}	0.831 (0.022)*		
Interact_ISO14_ISO14	-0.182 (0.021)*		
Constant	-27.602 (0.124)*		
Country Fixed Effects	No		
Industry Fixed Effects	Yes		
Observations	243,051		
R-Squared	0.472		
Root mean square error	2.530		
Notes: *,** significant at 5% and 10% respectively.			